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Cryptic Coloration



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Synonyms

[Concealing coloration](#); [Crypsis](#); [Obliterative coloration](#)

Definition

Colors and color patterns that reduce the risk of an object being visually detected when it is potentially perceivable to an observer

Introduction

Avoiding detection by undesirable viewers is a key antipredator strategy, and the evolutionary solutions to this challenge are myriad. Crypsis – the use of color patterns to minimize the probability of detection – is the most prevalent form of visual camouflage and has served as an exemplar of adaptation since the inception of modern evolutionary biology (Poulton 1890). The seminal work of Abbott Thayer (1909) in *Concealing Coloration in the Animal Kingdom* and Hugh Cott (1940) in *Adaptive Coloration in Animals* lays the

formal foundations for the study of crypsis, and camouflage more generally, which has since burgeoned into an active field of inquiry spanning biology, art, and technology (Behrens 2009).

Mechanisms

The functions of cryptic color patterns have often been considered obvious, though a breadth of work continues to detail the subtle complexity of this mode of defense. Confusion surrounding the language used to describe such colors has complicated efforts, though recent calls to focus on the perceptual effects, rather than the superficial appearance, of color patterns, have proven fruitful. Stevens and Merilaita (2009) take a broad view of crypsis and summarize six principle mechanisms:

1. *Background matching* describes the use of color patterns that approximate the appearance of the broader viewing background (in color and/or brightness) and so allow an object to blend in to its surrounds.
2. *Self-shadow concealment* is achieved via countershading, wherein darker colors adorn an object's upper side and lighter colors cover its underside. This can obscure the presence of conspicuous shadows generated by directional light sources (typically the sun), which can reveal the location of otherwise inconspicuous objects.

3. *Obliterative shading* is also achieved via counter-shading, though here the ultimate effect is to destroy the three-dimensional form of an object by disrupting the lighting cues that underlie its perception.
4. *Disruptive coloration* relies on the use of conspicuous, contrasting markings to generate the illusion of false edges and boundaries, thereby impeding the detection and recognition of an object's "true" form.
5. *Flicker-fusion camouflage* is a dynamic form of cryptic coloration in which color patterns rely on motion-induced blurring for their background-matching, cryptic effect.
6. *Distractive markings* deflect the attention of a receiver away from identifying characteristics, such as the distinctive outlines of body regions, to prevent their detection.

These mechanisms are non-exclusive and are typically combined to achieve a more robust cryptic effect. Self-shadow concealment and oblitative shading, for example, may draw on a similar counter-shaded appearance to simultaneously exploit the disruption of both an object's shadow and three-dimensional form (Rowland 2009). Similarly, disruptive coloration can be fruitfully combined with background matching to achieve "differential blending," wherein some components of a color pattern strongly contrast with viewing backgrounds while others are closely matched (Barry et al. 2015). This enhances the broader disruptive effect and can thus more efficiently obscure an object's true form.

Cryptic Coloration in Art and Technology

Many of the principles that describe the efficacy of crypsis can also be found – and even trace their origins – to the visual arts. Abbott Thayer was himself an artist and regularly acknowledged the role of his artistic training in shaping his thinking on adaptive coloration (Behrens 2009). He was also quick to chide his contemporaries that lacked a similar appreciation, even suggesting that they

were incapable of understanding the adaptive function of visual camouflage because it:

...can be interpreted only by painters. For it deals wholly in optical illusion, and this is the very gist of a painter's life. He is born with a sense of it; and, from his cradle to his grave, his eyes, wherever they turn, are unceasingly at work on it, – and his pictures live by it. What wonder then, if it was for him alone to discover that the very art he practices is at full – beyond the most delicate precision of human powers – on almost all animals? Thayer (1909, p. 3)

Thayer's work also directed efforts at improving the state of military camouflage during World War I, which has continued through to the present day. Cryptic patterns are now standard features of modern military uniforms, for example, and both disruptive and background-matching elements feature prominently on camouflage for vehicles and installations (Newark et al. 2002). As in the natural world, motion, shadowing, and surface texturing are enduring challenges to the effectiveness of cryptic coloration, as they can reveal the presence of objects irrespective of their appearance. The development of radar has also rendered the use of visual camouflage largely irrelevant for larger structures, in the same way that an animal's crypsis may be broken by the use of different sensory modalities.

Conclusion

Cryptic coloration is widespread form of visual camouflage in which color patterns are used to minimize the probability of visual detection by undesirable viewers. It has served as a key example of adaptation by natural selection, with far-reaching consequences across human domains of study.

Cross-References

- ▶ [Adaptation](#)
- ▶ [Camouflage](#)
- ▶ [Disruptive Coloration](#)
- ▶ [Predator Defence](#)
- ▶ [Visual Recognition of Prey and Predators](#)

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